

16(1)

AUTHOR:

Ivanovskiy, L.N.

SOV/155-58-3-11/37

TITLE:

Primary Components of Homotopic Spherical Groups (Primarnyye komponenty gomotopicheskikh grupp sfer)

PERIODICAL:

Nauchnyye doklady vysshey shkoly. Fiziko-matematicheskiye nauki, 1958, Nr 3, pp 53-63 (USSR)

ABSTRACT:

Theorem: For every $j \geq 1$ and every odd prime number $p \geq \sqrt{\frac{j+4}{2}}$ the component, primary with respect to p , of the homotopy group $\pi_{n+j}(S^n)$ of the sphere S^n , $n > j+1$ is trivial if $j+1$ is not divisible by $2(p-1)$ and it is isomorphic to the group \mathbb{Z}_p if $j+1$ is divisible by $2(p-1)$.
The author mentions that an analogous result for $p \geq \sqrt{\frac{j+9}{6}}$ is due to Moore [Ref 4].

The proof of the theorem bases on the lemma: For every prime number $p \geq 3$ and every j with $1 \leq j \leq \min(2p-4, n-3)$ it holds:

$$\pi_{n+j}(S^n)_p \cong \mathbb{Z}_p \text{ if } j+1 \equiv 0 \pmod{2(p-1)}$$

$$\pi_{n+j}(S^n) \oplus \mathbb{Z}_p = 0 \text{ if } j+1 \not\equiv 0 \pmod{2(p-1)}$$

Card 1/2

Moscow State U.

16(1)
AUTHOR: Ivanovskiy, L.N. SOV/20-123-5-4/50
TITLE: On a Conjecture of P.S.Aleksandrov (Ob odnoy gipoteze P.S. Aleksandrova)
PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 123, Nr 5, pp 785-786 (USSR)
ABSTRACT: The author proves the following conjecture of P.S.Aleksandrov: Every bicomact topological group is a diadic bicomactum. The proof is based on three lemmas, where the results of Pontryagin [Ref 2] and Gleason [Ref 3] are used. There are 3 references, 2 of which are Soviet, and 1 American.
ASSOCIATION: Moskovskiy gosudarstvennyy universitet imeni M.V.Lomonosova (Moscow State University imeni M.V.Lomonosov)
PRESENTED: July 21, 1958, by P.S.Aleksandrov, Academician
SUBMITTED: May 5, 1958

Card 1/1

IVANOVSKIY, L.H.

Epigenetic valleys in the Altai. Izv. Vses. geog. ob-va 92
no. 5: 449-456 S-O '60. (MIRA 13:9)
(Altai--Canyons)

IVANOVSKIY, L.N., kand.geograf.nauk

Lake Maashey. Priroda 50 no. 3:106 Mr '61. (MIRA 14:2)

1. Tomskiy gosudarstvennyy universitet im.V.V. Kuybysheva.
(Maashey, Lake)

IVANOVSKIY, L.N.

Some problems of glacial dynamics in the Altai. Izv.Vses.geog.
ob-va 93 no.5:423-425 S.-O '61. (MIRA 14:10)
(Altai Mountains--Glaciers)

IVANOVSKIY, L.N.

Study of the recent glaciation of the Katun' Basin in the Altai.
Sib.geog.sbor. no.18184-189 '62. (MIRA 16:2)
(Katun' Valley—Glaciological Research)

IVANOVSKIY, L.N.

Fifty years of the research and teaching activities of Mikhail
Vladimirovich Tronov. Izv.Vses.geog.ob-va 95 no.3:265
My-Je '63. (MIRA 16:3)
(Tronov, Mikhail, Vladimirovich, 1892-)

IVANOVSKIY, L.N.

Distribution, morphology, and origin of cirques in the
Altai. Sib. geog. sbor. no.4:152-198 '65.

(MIRA 18:12)

IVANOVSKIY, L.N.

New data on ancient glaciation in the Upper Chuya Valley.
Geog. sbor. no.17:158-170 '64. (MIRA 18:8)

IVANOVSKIY, L.N.

Cohomologies of Steenrod algebra. Dokl. AN SSSR 157 no.6:1284-
1287 Ag '64. (MIRA 17:9)

1. Matematicheskiy institut im. V.A. Steklova AN SSSR. Preistavleno
akademikom P.S. Aleksandrovym.

IVANOVSKIY, L. Ye.

"A study of the thermodynamics of certain reactions of thorium compounds at high temperatures." Min Higher Education USSR. Ural Poltechnis Inst imeni S. M. Kirov. Sverdlovsk, 1956 (Dissertations for the Degree of Candidate in Chemical Sciences)

SO: Knizhnaya letopis', No. 16, 1956

AUTHOR: IVANOVSKIY, L. YE. Smirnov, M.V. and Ivanovskiy, L. 555
 TITLE: Study of the thermodynamics of the reaction $\text{ThO}_2 + \text{C} + 2\text{Cl}_2 = \text{ThCl}_4 + \text{CO}_2$ and $\text{ThO}_2 + \text{C} = \text{Th} + \text{CO}_2$ by the electromotive force method. (Izuchenie Termodinamiki Reaktsii $\text{ThO}_2 + \text{C} + 2\text{Cl}_2 = \text{ThCl}_4 + \text{CO}_2$ i $\text{ThO}_2 + \text{C} = \text{Th} + \text{CO}_2$ metodom elektrodvizhusnchikh sil).
 PERIODICAL: "Zhurnal Neorganicheskoy Khimii" (Journal of Inorganic Chemistry) Vol. II, No. 2, pp. 238-243, 1957. (U.S.S.R.)
 ABSTRACT: Although it is impossible to construct the normal type of cell for the study of reactions of thorium dioxide with carbon and chlorine, the authors' previous observation that thorium dissolves at the anode in fused ThCl_4 without appreciable polarization at potentials close to the equilibrium value for Th/Th^{++} enables the decomposition potentials of this salt to be measured and the thermodynamics of its formation from the elements to be determined. For this reason attention could be concentrated on the study of the thermodynamics only of the chlorination reaction. The e.m.f. of the cell with a chlorine and oxide-carbon electrodes of thorium in fused eutectic mixture of lithium and potassium chlorides containing 3.07 wt.% of ThCl_4 was measured. In the range 655 - 960° a linear relation with temperature was found according to the empirical equation:

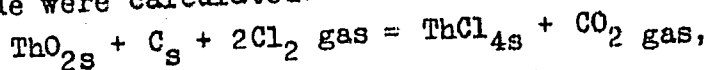
Card 1/3

555

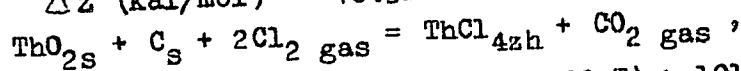
Study of the thermodynamics of the reaction $\text{ThO}_2 + \text{C} + 2\text{Cl}_2 = \text{ThCl}_4 + \text{CO}_2$ and $\text{ThO}_2 + \text{C} = \text{Th} + \text{CO}_2$ by the electromotive force method. (Contd.)

$$E = (0.4005 + 4.967 \times 10^{-4} T) \pm 0.0033 \text{ volts.}$$

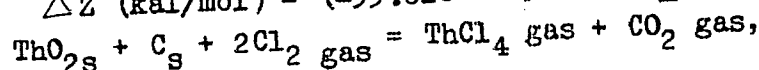
Changes in the isobaric potential in the chlorination reaction for the formation of solid, liquid and gaseous thorium tetrachloride were calculated:



$$\Delta Z \text{ (kal/mol)} = -78.310 - 4.2 T;$$



$$\Delta Z \text{ (kal/mol)} = (-55.810 - 25.76 T) \pm 1014;$$



$$\Delta Z \text{ (kal/mol)} = -19310 - 56.33 T.$$

For the reaction $\text{ThO}_{2s} + \text{C}_s + \text{Th}_s = \text{CO}_{2 \text{ gas}}, \Delta Z = (200.090 - 77.47 T) \pm 1134 \text{ kal/mol.}$

Card 2/3

137-58-6-11869

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 98 (USSR)

AUTHORS: Ivanovskiy, L.Ye., Smirnov, M.V.

TITLE: Behavior of Anodes of the Lower Titanium Oxides in the Electrolysis of Fused Chlorides of the Alkali Metals (Povedeniye anodov iz nizshikh okislov titana pri elektrolize rasplavlennykh khloridov shchelochnykh metallov)

PERIODICAL: Izv. vost. fil. AN SSSR, 1957, Nr 10, pp 68-74

ABSTRACT: Investigations of the electrochemical behavior of anodes made of the lower Ti oxides are conducted. Determination is made of the electrolysis products of a fused mixture of Li and K chlorides with anodes of Ti monoxide and sesquioxide. It is found that at 500°C and an anode cd of 0.1 amps/cm² the potential of TiO anodes is ~0.45 v more negative than that of the potential of Ti₂O₃ anodes. Depending upon the anode potential, ions of 2-, 3-, or 4-valent Ti go into the electrolyte. O remains in the solid phases, with the result that a TiO₂ phase is liberated at the surface of the anodes. Polarization of TiO and Ti₂O₃ anodes at 500° in the current density interval of from 10⁻³ to 5 amps/cm² was studied. It is established that Ti₂O₃

Card 1/2

137-58-6-11869

Behavior of Anodes (cont.)

anodes are polarized more completely than TiO anodes. As electrolysis proceeds, the potential of both types of anodes rises until a TiO_2 phase forms in their surface layer.

N.P.

1. Anodes (Electrolytic cell)--Electrochemistry
2. Titanium oxides--Properties
3. Alkali metal halides--Electrolysis

1. Ural'skiy filial AS SSSR

Card 2/2

79-2-4/58

AUTHORS: Smirnov, M. V., and Ivanovskiy, L. Ye.

TITLE: Uranium Dioxide Anodes in a Melted Chloride Electrolyte (Anody iz dvoukisi urana v rasplavlennom khlordnom elektrolite)

PERIODICAL: Zhurnal Obshchey Khimii, 1957, vol 27, No 2, pp. 295-299 (U.S.S.R)

ABSTRACT: Uranium dioxide electrodes were prepared which could be used in the role of anodes in the electrolysis of melted chlorides at current densities of up to 3 A/cm^2 . The basic dioxide was derived by the reduction of urano-uranic oxide with hydrogen at 700° . The oxide was black and its chemical composition corresponded to the empirical formula UO_2O_4 . The characteristics of the anodes were investigated in a melted lithium and potassium chloride mixture at 650° and it was observed that at a current density of 0.001 to 1 A/cm^2 they dissolve forming in the electrolyte uranyl ions with a 100% yield according to the current input. The oxygen surplus accumulates in the anode and the UO_2^{++} ions during the cathode discharge produce a uranium dioxide residue of stoichiometric composition. The anodic

Card 1/3

Uranium Dioxide Anodes in a Melted Chloride Electrolyte. 79-2-4/58

solution of the uranium dioxide occurs with a small polarization connected with the concentrational changes in the near-electrode electrolyte layer at a potential which is close to equilibrium.

Since the UO_2^{++} ion discharge potential on the cathode was approximately by 1 v more positive than the metallic uranium separation potential, even the slightest oxygen contaminations of the electrolyte led to the contamination of the metal cathode residues by the dioxide. The uranium dioxide anode polarization was measured in a chloride melt at 550° and it was found that at current densities below 0.05 A/cm^2 the anode potential was by 0.57 v more negative than the potential of the chloride electrode and that the potential varies little with current density. Considerable polarization was observed at a current density above 0.05 A/cm^2 .

Card 2/3

1 table, 1 graph, 1 drawing. There are 10 references, of which 3 are Slavic.

IVANOVSKIY, L.YE.
USSR / Physical Chemistry - Electrochemistry.

B-12

Abs Jour : Referat. Zhurnal Khimii, No.1, 1958, 579.

Author : M.V. Smirnov, L.Ye. Ivanovskiy.

Inst : -

Title : Voltage of Dissociation of Melted Lead and Thorium Chlorides.

Orig Pub : Zh. fiz. khimii, 1957, 31, No.2, 467 - 473.

Abstract : A cell with a Th electrode and an auxiliary W cathode separated from a chlorine comparison electrode with an asbestos diaphragm was used for measuring the voltage of dissociation E of pure melted ThCl_4 . $E = (2.772 - 5.61 \cdot 10^{-4}T) \pm 0.0013$ v in the range from 830 to 0170. The developed method was checked by the determination of E of PbCl_2 , for which it was found that $E = 1.582 - 6.2 \cdot 10^{-4}T$ v, which agrees well with bibliographic data. ΔZ for following reactions were computed: $\text{Th(sol.)} + 2\text{Cl}_2(\text{gas}) \rightarrow \text{ThCl}_4(\text{liqu.})$;

Card: 1/2

USSR/ Physical Chemistry - Electrochemistry/

B-12

Abs Jour : Referat. Zhurnal Khimiya, No.1 1958, 579.

Abstract : $\Delta Z = (-255700 + 51.75T) - 120$ cal per mole; and $\text{Th(sol.)} + 2\text{Cl}_2(\text{gas}) = \text{ThCl}_4(\text{solid})$; $\Delta Z = -278200 + 72.3T$ cal per mole. It is shown that anode dissolution of Pb and Th in their melted chlorides proceeds without any noticeable polarization at potentials near the equilibrium potentials of the metals referred to their ions of the highest valency.

Card: 2/2

IVANOVSKIY, L.YE.
USSR / Physical Chemistry - Electrochemistry.

B-12

Abs Jour : Referat. Zhurnal Khimiya, No.1, 1958, 580.

Author : M.V. Smirnov, L.Ye. Ivanovskiy.

Inst : -

Title : Reduction of Th^{4+} Ions in Chloride Melts with Metallic Thorium.

Orig Pub : Zh. fiz. khimii, 1957, 31, No.4, 802 - 807.

Abstract : At the interaction between metallic Th with the eutectic mixture LiCl-KCl containing 6 to 11% of ThCl_4 at 500 to 900°, Th dissolves in the melt at the expense of the reduction of Th^{4+} to Th^{2+} . In the same melt and at the ThCl_4 content of 5.83%, the equilibrium potentials E of the Th- and Mo- (indifferent) electrodes are equal and change with the temperature (from 510 to 897°) according to the equation $E = (-3.231 + 8.936 \times 10^{-4}T) \pm 0.02$ v. The equilibrium potentials E° for the electrode processes $\text{Th} - 2e \rightleftharpoons \text{Th}^{2+}$

Card: 1/2

USSR / Physical Chemistry - Electrochemistry.

B-12

Abs Jour : Referat. Zhurnal Khimiya, No.1, 1958, 580.

Abstract : and $\text{Th}^{2+} - 2e \rightleftharpoons \text{Th}^{4+}$, referred to the chlorine comparison electrode were computed and they were $E^\circ = -3.231 + 10.968 \times 10^{-4}T$ and $E^\circ = -1.905 - 1.484 \times 10^{-4}T$ correspondingly. Approximate magnitudes of ΔZ of the reactions $\text{Th}(\text{sol.}) + \text{Cl}_2(\text{gas}) = \text{ThCl}_2(\text{liqu.})$ and $\text{Th}(\text{sol.}) + \text{ThCl}_4(\text{liqu.}) = 2\text{ThCl}_2(\text{liqu.})$ were found and they were $\Delta Z = -149000 + 32.80T$ cal per mole for the first reaction and $Z = -21150 + 7.02T$ cal per mole for the second.

Card: 2/2

IVANOVSKIY, L. Ye.

USSR/Physical Chemistry - Thermodynamics, Thermochemistry, Equilibria,
Physical-Chemical Analysis, Phase Transitions.

B-8

Abs Jour: Referat. Zhurnal Khimiya, No 2, 1958, 3796.

Author : M.V. Smirnov, N.G. Il'yushchenko, S.P. Detkov, L.Ye. Ivanovskiy.

Inst :

Title : Solubility of Thorium in Liquid Zinc.

Orig Pub: Zh. fiz. khimii, 1957, 31, No 5, 1013-1018.

Abstract: Alloys of Zn with Th containing up to 25% by weight of Th were investigated by the methods of electron-photographic, metallographic and thermal analyses. The structural component alloys are practically pure Zn and the metallic compound $\text{Th}_2\text{Zn}_{17}$ (I), the composition of which has been established by chemical analysis. The solubility of Th in Zn was determined, it is $3.55 \cdot 10^{-3} \%$ at 419.4° and 1.44% at 907° . It was found that the isobaric potential changes at the formation of I from the elements, and the activities with activity factors of Th in the binary alloy I

Card : 1/2

-34-

66974

SOV/81-59-13-45035

5.2200(A) 5.4700
5.4600(A)

Translation from: Referativnyy zhurnal. Khimiya, 1959, Nr 13, p 44 (USSR)

AUTHORS: Smirnov, M.V., Ivanovskiy, L.Ye., Pal'guyev, S.F., Volchenko, Z.S.,
Yushina, L.D.

TITLE: The emf-Method for Studying the Thermodynamics of Some Reactions at
High Temperatures ²¹

PERIODICAL: Tr. in-ta khimii. Ural'skiy filial AS USSR, 1958, Nr 2, pp 143 - 151

ABSTRACT: In the electrolysis of fused chloride baths CO₂ is separated on the anodes prepared from an intimate mixture of oxides and carbon and the ions of the corresponding metals pass into the electrolyte. The oxide-carbon electrodes of thorium, calcium, beryllium, etc. in equilibrium are reversible in relation to their ions being in the electrolyte. This permits to utilize them by the emf-method for elucidating the thermodynamics of reactions, in which oxides and carbon take part at high temperatures. The equilibrium potentials of the electrodes are determined by the activity of the ions of the corresponding metals in the electrolyte and by the CO₂ pressure over them according to the electrode reaction $M_2O_n + n/2C - 2ne \rightleftharpoons 2M^n + (fusion) + n/2CO_2$, $E =$ ✓

Card 1/2

66974

SOV/81-59-13-45035

The emf-Method for Studying the Thermodynamics of Some Reactions at High Temperatures

$\text{const} + (RT/n) \ln a_{\text{Mn}} + (RT/4F) \ln p_{\text{CO}_2}$. They do not depend on the molar ratio of CO and carbon. By measuring emf the changes can be found in the isobaric potential ΔZ , in the enthalpy ΔH and entropy ΔS of the corresponding reactions of chlorination $\text{M}_2\text{O}_n + n/2\text{C} + n\text{Cl}_2 = 2\text{MCl}_n (\text{smelt}) + n/2\text{CO}_2$. Oxide-carbon electrodes in combination with metal electrodes made it possible to study the thermodynamics of the interaction of the fused chlorides of thorium, beryllium and calcium with the chlorides of the alkali metals. For determining the decomposition tension of the fused chlorides of higher valencies a method has been developed permitting to measure the value of the decomposition tension of PbCl_2 and ThCl_4 . The change in the thermodynamic parameters has been calculated for the reaction $\text{Th} (\text{solid}) + 2\text{Cl}_2 (\text{gas}) = \text{ThCl}_4 (\text{liquid})$, $\Delta Z = 2.772 - 5.61 \cdot 10^{-4} T$. Based on the emf of the cell $\text{Th} | \text{ThCl}_2 || \text{KCl}, \text{ThCl}_4 | \text{Cl}_2, \text{C}$, it has been found for the decomposition tension of ThCl_2 ; $E = 3.27 - 10.8 \cdot 10^{-4} T$, $\Delta Z = 150,900 + 49.7T$ cal/mole. For the reaction $\text{ThCl}_4 (\text{liquid}) + \text{Th} (\text{solid}) = 2\text{ThCl}_2 (\text{liquid})$, $\Delta Z = -23,000 + 23.8T$ cal/mole ThCl_2 . The thermodynamics of the formation of alloys of thorium with zinc has been studied. For the reaction of reducing ThO_2 by carbon to metal $\Delta Z = 20,000 - 77.5T$ cal/mole.

A. Zolotarevskiy

Card 2/2

SMIRNOV, M.V.; IVANOVSKIY, L.Ye.; YUSHINA, L.D.

Equilibrium potentials of metals in molten salts.
Trudy Inst. khim. UFAN SSSR no.2:153-159 '58.

(MIRA 12:12)

(Electrometallurgy)

67024

SOV/137-59-10-21896

5.1310(A)

Translation from: Referativnyy zhurnal, Metallurgiya, 1959, Nr 10, p 92 (USSR)

AUTHORS: Smirnov, M.V., Yushina, L.D., Ivanovskiy, L.Ye.

TITLE: Deposition of High-Melting Metals From Molten Electrolytes

PERIODICAL: Tr. in-ta khimii, Ural'skiy fil. AS USSR, 1958, Nr 2, pp 161 - 170

ABSTRACT: The authors investigated processes which take place on a Me-cathode in electrolysis of chloride and chloride-fluoride smelts, containing Th, Be, Zr, Ti and other metals. It is shown that electrolysis of molten metallic salts is accompanied with an overcharge on the cathode of ions of conventional to lowest valencies. This is the cause for the existence of residual currents, which entail reduced cathode yield per current in electrolyzers without diaphragms or in open baths. In closed electrolyzers with diaphragms the yield per current increases. The structure of the cathode deposit (dimension and cohesion of particles) depends on the presence of suspended submicroscopic particles of oxycompounds in the electrolyte. During the formation of crystalline deposits true D_k increases, with higher current intensity of electrolysis, considerably slower than the rated value, calculated from the geometrical surface of

Card 1/2

67024

Deposition of High-Melting Metals From Molten Electrolytes

SOV/137-59-10-21896

the initial cathode. When the limiting diffusion current of ion discharge of the metal obtained from mixed electrolytes is attained, the cathode potential increases rapidly up to a magnitude where the joint separation of alkali metals begins. The yield per current decreases sharply during the joint deposition of alkali metals. ✓

G.S.

Card 2/2

67628

30V/81-59-14-50263

5.1310

Translation from: Referativnyi zhurnal, Khimiya, 1959, Nr 14, p 322 (USSR)

AUTHORS: Smirnov, M.V., Ivanovskiy, L.Ye., Krasnov, Yu.N.

TITLE: The Electrochemical Behavior of Lower Oxides, Nitrides and Carbides of Some Metals

PERIODICAL: Tr. in-ta khimii. Ural'skiy fil. AS USSR, 1958, Nr 2, pp 177 - 182

ABSTRACT: The behavior of lower oxides, nitrides, and carbides of ¹Ti and ¹U in a smelt of chlorides has been studied. In proportion to the dissolution the anode is enriched by another component, if the diffusion rate of the component into the interior of the anode is less than the dissolution rate of the anode. An anode of UO_2 forms UO_2^{2+} cations. The lower Ti oxides from Ti^{2+} and Ti^{3+} cations at low D and Ti^{3+} and Ti^{4+} at high D. The cathode Ti precipitate does not contain oxides. Anodes of TiN and TiC are less suitable; separation of the anode and cathode spaces is needed. The possibility of obtaining Ti by electrolysis of smelts with soluble anodes and the refining of polluted Ti has been shown.

K. Krivolutskiy

Card 1/1

5(2)

AUTHORS:

Ivanovskiy, L. Ye., Loginov, N. A.,
Smirnov, M. V.

SOV/75-13-6-10/21

TITLE:

Determination of Bi- and Trivalent Titanium in Chloride Melts
by Ferric Chloride (Opredeleniye dvukh- i trekhvalentnogo
titana v khloridnykh rasplavakh posredstvom khlornogo zheleza)

PERIODICAL:

Zhurnal analiticheskoy khimii, 1958, Vol 13, Nr 6, pp 671-673
(USSR)

ABSTRACT:

A thorough investigation of the electrolysis of salt melts containing titanium requires a separate determination of bi- and trivalent titanium in the electrolyte. The determination methods (Refs 1,2) hitherto known do not always yield satisfactory results. For direct determination of the valences of titanium in the salt melt the oxidation of titanium with ferric chloride immediately in the melt with a parallel determination of the trivalent Ti in an aqueous electrolyte solution is most suitable. This method, however, is complicated by the thermal dissociation and the volatility of FeCl_3 . At high temperatures ferric chloride is considerably decomposed. It is, therefore, useful not to melt the sample to be analyzed with pure FeCl_3 but with its melts formed with alkali metal chlorides. For

Card 1/4

is obtained. In higher concentrations this phase has a constant composition. This phase is separated on the bottom. This phase has a constant composition. After

Determination of Bi- and Trivalent Titanium in
Chloride Melts by Ferric Chloride

SOV/75-13-6-10/21

ASSOCIATION: Institut khimii Ural'skogo filiala AN SSSR, Sverdlovsk
(Sverdlovsk Chemical Institute of the Ural Branch, AS USSR)

SUBMITTED: April 27, 1957

Card 4/4

AUTHORS: Smirnov, M. V., Ivanovskiy, L. Ye. SOV/76-32-9-34/46

TITLE: Cathodic Processes in the Deposition of Beryllium From Molten Electrolytes (Katodnyye protsessy pri osazhdenii berilliya iz rasplavlennykh elektrolitov)

PERIODICAL: Zhurnal fizicheskoy khimii, 1958, Vol 32, Nr 9, pp 2174-2182 (USSR)

ABSTRACT: The authors investigated the polarization of a molybdenum cathode at temperatures of 400°, 500°, and 600°C. The current density ranged from 10^{-3} to 3 A/cm². The electrolyte consisted of a melt of a potassium chloride and lithium chloride eutectic mixture (Fig 2) with 0,1, 1,9, and 7,25 wt.-% of BeCl₂ (Fig 3) or 3,9 wt.-% of K₂BeF₄ (Fig 4) added. Figure 1 illustrates the electrolytic cell used. It was found that with current densities below 10^{-3} A/cm² Li⁺ and K⁺ are reduced to the respective divalent ions Li₂⁺ and K₂⁺ at the cathode. The deposition potential of beryllium lies 1,2 to 1,4 V above that of the alkali metals, depending on the temperature and concentration. The addition of fluoride considerably raises the deposition po-

Card 1/2

SOT/76-32-9-54/46

Cathodic Processes in the Deposition of Beryllium From Molten Electrolytes

tential of the beryllium at the cathode, but does not affect the deposition of the alkali metals. There are 4 figures and 13 references, 6 of which are Soviet.

ASSOCIATION: Ural'skiy filial Akademii nauk SSSR, Sverdlovsk (Ural Branch AS USSR, Sverdlovsk)

SUBMITTED: April 20, 1957

Card 2/2

5(4)

SOV/20-121-4-31/54

AUTHORS:

Smirnov, M. V., Ivanovskiy, L. Ye., Loginov, N. A.

TITLE:

The Equilibrium Potentials of Titanium in Chloride Melts
(Ravnovesnyye potentsialy titana v khlordnykh rasplavakh)

PERIODICAL:

Doklady Akademii nauk SSSR, 1958, Vol 121, Nr 4, pp 685-688
(USSR)

ABSTRACT:

The authors measured the equilibrium potentials in pure argon in a hermetically closed wide test tube of quartz. On the bottom of this tube there was an eutectic mixture of lithium chloride and potassium chloride. An electrode of titanium iodide was fastened to a molybdenum feeder and it was immersed in a salt melt of the same composition. The potential of the titanium electrode was measured with respect to a lead electrode. The results of the measurements, (with respect to a chlorine electrode of comparison) are given in a diagram which demonstrates the dependence of the electromotive force on the temperature for various given concentrations of the titanium in the electrolyte. The experimental points agree well with straight lines. Another diagram shows the isothermal lines deduced from the above-mentioned results for 700, 800,

Card 1/3

SOV/20-121-4-31/54

The Equilibrium Potentials of Titanium in Chloride Melts

900, and 1000°K. The equilibrium potential of the metallic titanium electrode in chloride melts which contain less than 6 weight % of titanium depends on its molar concentration in the electrolyte according to the following thermodynamical equation:

$$E = E_{\text{Ti/Ti}^{2+}}^{\circ} + (2,3 \text{ RT}/2\text{F}) \lg [\text{Ti}^{2+}] .$$

This shows that such melts contain ions of divalent titanium and behave as ideal solutions. The quantity $E_{\text{Ti/Ti}^{2+}}^{\circ}$ may be found from the above-mentioned experimental data, $E_{\text{Ti/Ti}^{2+}}^{\circ} = (-2,371 + 6,09 \cdot 10^{-4}T) \text{ V}$ is obtained with respect to the chlorine electrode. For the calculation of the isobaric potential for the composition of the liquid titanium dichloride from the elements the equation $\Delta Z = (-109 \text{ 360} + 27,03 \text{ T}) \text{ cal/mol TiCl}_2$ may be used. There are 4 figures and 12 references, 3 of which are Soviet.

Card 2/3

IVANOVSKIY, L.YE.

Smirnov, M.V., and L.Ye. Ivanovskiy (Institute of Chemistry, Urals Branch, Academy of Sciences USSR). Electrolysis of a Chloride Bath With Titanium Monoxide Anodes, p. 100. Titan i yego splavy. vyp. II: Metallurgiya titana (Titanium and Its Alloys. No. 2: Metallurgy of Titanium) Moscow, Izd-vo AN SSSR, 1959. 179 p.

This collection of papers deals with sources of titanium; production of titanium dioxide, metallic titanium, and titanium sheet; slag composition; determination of titanium content in slags; and other related matters. The sources of titanium discussed are the complex sillimanite ores of the Kyakhtinskoye Deposit (Buryatskaya ASSR) and certain aluminum ores of Eastern Siberia. One paper explains the advantages of using ilmenite titanium slags for the production of titanium dioxide by the sulfuric acid method. Production of metallic titanium by thermal reduction processes (hydrogen, magnesium, and carbon reduction) is the subject of several papers, while other papers are concerned with the electrolytic production of titanium. Other subjects dealt with are interaction of titanium with water vapor and with hydrogen and the determination of titanium in slags.

SMIRNOV, M.V.; IVANOVSKIY, L.Ye.

Electrolysis of the chloridizing bath with anodes of titanium
oxide. Titan i ego splavy no.2:100-102 '59.
(MIRA 13:6)

1. Institut khimii Ural'skogo filiala AN SSSR.
(Titanium--Electrometallurgy)

S.4700

31670
S/631/60/000/001/007/014
B117/B147

AUTHORS: Ivanovskiy, L. Ye., Krasil'nikov, M. T.

TITLE: Electrode processes and effect of oxygen in electrolytic precipitation of niobium from potassium fluoniobate

SOURCE: Elektrokimiya rasplavlennykh solevykh i tverdykh elektrolitov, no. 1, 1960, 49-54

TEXT: The authors studied processes on electrodes and the role of oxygen in the precipitation of niobium from potassium fluoniobate, they examined the cathodic and anodic polarizations and analysed the cathode deposits obtained under various conditions. Chemically pure sodium chloride and potassium fluoniobate separated from aqueous solutions and dried in vacuum drying chambers at 150 - 170°C were used as initial salts. Polarization was measured with a graphite vessel, 5 - 6 cm in diameter, serving as anode, a standard electrode, a cathode, and an additional anode of spectroscopically pure carbon. A loop oscilloscope was used to measure the polarization of a molybdenum cathode in sodium chloride melt with 5,

Card 1/3

Electrode processes and effect of oxygen ... ³¹⁶⁷⁰S/631/60/000/001/007/014 B117/B147

10, 20, and 30% by weight of potassium fluoniobate at $850 \pm 15^\circ\text{C}$ with a current density ranging from 10^{-3} to 6 a/cm^2 at the moment when the polarizing current was switched off. With increasing current density several cathodic processes took place. At low current densities ($0.3 - 0.4 \text{ a/cm}^2$) niobium is reduced to the lowest valences. At higher current densities ($0.6 - 0.8 \text{ a/cm}^2$), first metallic niobium, then alkaline metal are separated. The behavior of oxygen in the bath was studied in the anodic polarization of a graphite anode in pure sodium chloride, and also in a melt containing 10% by weight of potassium fluoniobate. The polarization curve showed two sections: one apparently corresponded to the process of ionic charge exchange, the other one to the discharge of oxygen with formation of carbon dioxide. The cathodic products obtained under different conditions were analyzed in an open bath of sodium chloride with a potassium fluoniobate content of up to 15% by weight at $850 \pm 15^\circ\text{C}$. A graphite vessel was used as anode and a molybdenum rod as cathode. When nondehydrated (air-dried) salts were used, a metal containing oxide impurities might be deposited on the cathode. In most cases, the cathode

Card 2/3

31671
S/631/60/000/001/008/014
B117/B147

5.4700

AUTHORS: Ivanovskiy, L. Ye., Ilyushchenko, N. G., Zyazev, V. L.,
Plekhanov, A. F.

TITLE: Oxychlorides of rare earths of lowest valencies

SOURCE: Elektrokimiya rasplavlennykh solevykh i tverdykh elektrolitov,
no. 1, 1960, 55-60

TEXT: The interaction of oxygen and rare earth metals with chloride melts of rare earths was studied. In the first series of experiments, the authors used a misch metal (% by weight: 22.5 La, 53.0 Ce, 4.53 Pr, and 16.3 Nd) obtained by electrolysis, and a chloride mixture (% by weight: 26 La, 53.9 Ce, 4.85 Pr, 11.42 Nd) obtained by chlorination of oxides of rare earths with gaseous chlorine in the presence of carbon. The result was a deposit of oxychlorides of lowest valency: Me_2OCl_2 , where Me stands for La, Ce, Pr, and Nd. This mixture is slowly hydrolyzed in water to give hydrates of highest valency. When boiling, decomposition proceeds rather quickly. During heating, the product readily reacts with acids, particularly

Card 1/3

Oxychlorides of rare earths of lowest ...

31671
S/631/60/000/001/008/014
B117/B147

nitric acid. It oxidizes easily at 300-400°C forming mixtures of oxides of rare earths at higher temperatures. In another series of experiments, the reaction of oxygen with chlorides of rare earths in an open bath at 580 - 600°C was studied. A graphite vessel was used as electrolyzer and anode, and molybdenum rods were used as cathodes. The electrolyte was a mixture of chlorides of rare earths and potassium chloride (50% MeCl_3 and KCl). The amount of lowest oxychlorides formed in all experiments depended on the amount of products in the bath obtained by decomposition of salts under the action of oxygen and moisture. Finally, the misch metal in the potassium chloride melt was anodically dissolved at 850°C in an open and a closed bath. The authors always found oxychlorides of lowest valencies with a ratio equal to that of initial substances. Summary: In the case of interaction between oxygen, chloride melts of rare earths, and misch metal mixtures of low-valency oxychlorides of rare earths were obtained. The summational reaction can be written down:
$$4\text{MeCl}_3 + 3\text{O}_2 + 8\text{Me} = 6\text{Me}_2\text{OCl}_2$$

The formation of oxychlorides on the cathode may be explained by the formation of Me_2OCl_4 soluble in the melt by

Card 2/3

S/137/62/000/008/013/065
A006/A101

AUTHORS: Ivanovskiy, L. Ye., Petenev, O. S.

TITLE: Some processes in cathodic deposition of zirconium from chloride-fluoride melts

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 8, 1962, 28 - 29, abstract 8G201 ("Tr. In-ta elektrokhimii, Ural'skiy fil. AN SSSR", 1961, no. 2, 71 - 78)

TEXT: As a result of investigating cathodic deposits, obtained by electrolysis of fluoride-chloride Zr melts, it was found that at low D (0.01 - 0.1 amp/cm²) difficultly soluble double Zr salts of the NaZrF₄ or KZrF₄ type are formed on the cathode. At higher D, metal is also deposited, the more so as D increases. Properties and behavior of double Zr salts in the melts are investigated. Problems concerning the effect of by-processes on Zr and Hf separation in electrolysis are analyzed. There are 18 references.

G. Svodtseva

[Abstracter's note: Complete translation]

Card 1/1

S/137/62/000/008/012/065
A006/A101

AUTHORS: Ivanovskiy, L. Ye., Krasil'nikov, M. T.

TITLE: Anodic processes during niobium dissolving in chloride and chloride-fluoride melts

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 8, 1962, 27, abstract 8G193
("Tr. In-ta elektrokhimii. Ural'skiy fil. AN SSSR", 1961, no. 2, 79 - 83)

TEXT: In a first series of experiments the authors revealed the dependence of current efficiency in anodic Nb dissolving upon D and the composition of the bath. An equimolar mixture of K and Na chlorides was used as an electrolyte. The temperature was maintained at $700 \pm 10^\circ\text{C}$. It was established that the mean valence of Nb ions passing into the melt increased with higher D. At relatively low D_a (about 0.01 amp/cm^2) dissolving is accompanied by the formation of Nb^{2+} and Nb^{3+} ; at $D_a > 0.1 \text{ amp/cm}^2$ Nb^{4+} ions appear in the melt, and at high D Nb^{5+} ions appear. In the second series of experiments polarization of the Nb-anode was measured at $D = 10^{-3} - 5 \text{ amp/cm}^2$, various temperatures and different composi-

Card 1/2

S/137/62/000/008/011/065
A006/A101

AUTHORS: Ivanovskiy, L. Ye., Ilyushchenko, N. G., Plekhanov, A. F., Zyazev,
V. L.

TITLE: Separating rare-earth metals by fused salt electrolysis

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 8, 1962, 27, abstract 8G188
("Tr. In-ta elektrokhimii, Ural'skiy fil. AN SSSR", 1961, no. 2, 131 -
134)

TEXT: Separation of rare-earth metals was investigated in fused bath
electrolysis containing a mixture of rare-earth chlorides. It was found that at
all the D_c (0.25 - 1.5 amp/cm²) and temperatures (850 - 870; 560 - 700°C) inves-
tigated, alloys are obtained which are considerably impoverished of La (3 - 5
weight %) and enriched with Ce (up to 80%). The total Pr and Nd amount remains
practically constant. The nature of cathodic deposits varies noticeably with
temperature. Their salt content varies from 75 to 80% at 560°C and from 30 to
40% at 700°C. There are 11 references.

G. Svodtseva

[Abstracter's note: Complete translation]

Card 1/1

22343

S/200/61/000/004/003/005
D228/D305

18 3100

26 2521 also 1208

AUTHORS: Ivanovskiy L. Ye., Stepanov, G. K., Krasil'nikov, M. T.,
and Petenev, O. S.

TITLE: Study of the electrolytic solution of chlorine and
hydrogen chloride on inert electrodes

PERIODICAL: Akademiya nauk SSSR. Sibirskoye otdeleniye. Izvestiya,
no. 4, 1961, 48-53

TEXT: In order to obtain alkali and alkaline earth metals by
electrolysis from their fused salts, it is necessary in most cases
to maintain an optimum range of concentration during the process.
As building up and maintenance of the necessary concentration via
porous diaphragms represent difficulties, it was proved in this
work that this can be solved by using gas electrodes especially
the chlorine electrode. This involves a rapid cathodic solution
of chlorine which prevents the depositing of the metal and this in
turn compensates for the lowering of the metal's ionic concentration.
The purpose of this work was to study the behavior of the gas elec-

Card 1/6

Study of the electrolytic solution...

22343
S/200/61/000/004/003/005
D228/D305

trodes namely: chlorine and hydrogen chloride cathodes from graphite (or carborundum) in electrolysis of fused alkali chlorides. The use of gas electrodes can compensate for a lowering below the optimum range of the ionic concentration of the deposited metal. Graphite anode and cathode, porous electrode, and a Pb reference electrode were immersed in an electrolyte of unimolecular quantities of fused sodium and potassium chlorides at 800°C through which chlorine or hydrogen chloride was passed for 3 - 4 hours. When the potential reached the steady value, the cathode polarization for the range of current densities from 10^{-3} to 3 amp/cm² was measured by means of an oscillograph at the moment the current was cut off. Polarization measurement was conducted on a graphite electrode and a porous electrode which was a "silite" tube through which chlorine or hydrogen chloride was passed into the electrolyte. The results are given in Fig. 2. The curves represent the dependence of cathode potentials on current density (abscissae - cathode potentials; ordinates - log current density in amp/cm²). Curve 1: In the electrolyte saturated with chlorine. (The first part of the curve, up to the current density of 10^{-2} represents the cathode polarization of

Card 2/6

22313

Study of the electrolytic solution...

S/200/61/000/004/003/005
D228/D305

dissolved chlorine due to concentration changes in the vicinity of the electrode (not to the ionization of chlorine $\text{Cl} + e \rightarrow \text{Cl}^-$). Solubility of Cl_2 in fused $\text{KCl} + \text{LiCl} = 0.0038\%$ by weight obtained after 5 hours (after 1 hour it was 0.0013% which shows the speed of solubility)). Curve 2: In the electrolyte saturated with hydrogen chloride (solubility of HCl at $800^\circ\text{C} = 6.8 \cdot 10^{-4}\%$ by weight). The potential of the HCl electrode was less than that of the chlorine electrode by 0.7 v. Curve 3: In fused $\text{KCl} - \text{NaCl}$ not saturated with Cl_2 or HCl it practically concurs with Curve 2. Curves 4 and 5: On the porous "silite" electrode through which chlorine was passed. In the case of Curve 4 the chlorine used up 4 g/hr in $60 - 70 \text{ g}$ of electrolyte. Ionization of chlorine takes place without polarization over a wide range of current density. Curve 5 shows that for a higher amount of chlorine passed, higher current densities can be applied - although this results in greater loss of chlorine. The use of a porous electrode facilitates the ionization process. It can be assumed that cathodic ionization of chlorine is due to adsorption of gas on the electrode. With a fine porous electrode due to a larger electrochemically active surface and due to the pres-

Card 4/6

22343

Study of the electrolytic solution...

S/200/61/000/004/003/005
D228/D305

sure of gas passing through the pores, the ionization rate is greater and consequently the current density range can be increased. Curve 6: On the porous electrode through which HCl was passed. (Small polarization due to diffusion and due to the evolution of hydrogen). The authors conclude that in fused alkali chlorides saturated with chlorine of hydrogen chlorine, there is high concentration polarization. When porous electrodes with gas passing through their pores are used, the process of solution of chlorine takes place without polarization and that of hydrogen chloride with small polarization and with a potential lower than that of a chlorine electrode by 1 v. The use of the chlorine electrode is indicated although the hydrogen chlorine electrode is convenient to use in the case of electrolysis of salts of low-valent metals due to its lower potential. It is found that the highly porous electrodes of graphite or carborundum with chlorine or hydrogen chloride passing through them work efficiently in the preparation and purification of metals by electrolysis of their fused salts. It was also found that the chlorine electrode can be used in high temperature electrochemical generators. There are 2 tables, 2 figures and 11

Card 5/6

IVANOVSKIY, L.Ye.; PETENEV, O.S.

Hafnium behavior in the electrolytic production of zirconium from
chloride-fluoride melts. TSvet. met. 36 no.9:65-69 S '63.
(MIRA 16:10)

IVANOVSKIY, L.Ye.; ROZANOV, I.G.; KRASIL'NIKOV, M.T.; PLEKHANOV, A.F.

Electrolysis of chloride melts with anodes of HbO and HbO_2 .

Trudy Inst. elektrokhim. UFAN SSSR no.5:111-117 '64.

(MIRA 18:2)

L 38368-66 EWT(m)/EWP(t)/ETI IJP(c) JD/JG

ACC NR: AT6021369

(A)

SOURCE CODE: UR/2631/65/000/007/0069/0072

AUTHOR: Ivanovskiy, L. Ye.; Krasil'nikov, M. T.

ORG: none*

45
43
B+1

TITLE: Deposition of continuous cathodic deposits in the electrolysis of molten chloride baths containing NbCl_2

SOURCE: *AN SSSR. Ural'skiy filial. Institut elektrokhimii. Trudy, no. 7, 1965. Elektrokhiya rasplavlennykh solevykh i tverdykh elektrolitov; termodinamika i kinetika elektrodnykh protsessov (Electrochemistry of fused salts and solid electrolytes; thermodynamics and kinetics of electrode processes), 69-72

TOPIC TAGS: electrolytic deposition, niobium

ABSTRACT: Experiments on the deposition of compact niobium deposits were carried out in a closed electrolyzer under argon at 700-900°C. The electrolyte used was an equimolar mixture of potassium and sodium chlorides containing the necessary amount of niobium chloride. When the electrolyte - metal equilibrium was reached at the cathode, continuous niobium deposits 3-5 mm thick were obtained. The most compact deposits were formed at a current density of 0.1-0.2 A/cm² at 700-750°C, and the current efficiency, calculated in terms of the discharge of divalent niobium ions, was 97%. The deposits adhered better to a molybdenum base than to a niobium base because the latter was covered with an oxide film. Microhardness measurements of

Card 1/2

Document 1, 111

AUTHOR: Various Authors, see below.

4-9-23/25

TITLE: Fresh from the Press (Vyshli iz pechati)

PERIODICAL: Znaniya - Sila, 1957, # 9, pp 44 - 45 (USSR)

ABSTRACT: The article contains reviews of four newly published books.

In "The Way Faced" (Proydanny put') by S.Ya. Alliluyev, an old bolshevik recollects his underground activities, covering the period from 1890 until 1907.

In "What is a Semiconductor" (Chto takoye poluprovodnik) by Gleb Anfilov, published by Detgiz, semiconductors and the different ways of application are described.

In "The Solar Family" (Solntse i ego sem'ya) by M. Ivanovskiy, published by Detgiz, popular scientific account on basic astronomy is given.

"The Mysterious Continent" (Tainstvennyy materik) by L. Khvat, published by Geografiz, deals with the history of antarctic exploration and the scientific successes achieved by the Soviet antarctic expedition organized by the USSR Academy of Sciences (Akademiya Nauk SSSR).

There are 5 figures.

AVAILABLE:
Card 1/1

Library of Congress

ACCESSION NR: AT4025317

S/0000/63/000/000/0263/0269

AUTHORS: Batanov, G. M.; Ivanovskiy, M. A.; Fedyanin, O. I.; Shpi-
gel', I. S.

TITLE: Use of a luminescent probe to record a moving plasma

SOURCE: Diagnostika plazmy* (Plasma diagnostics); sb. statey.
Moscow, Gosatomizdat, 1963, 263-269

TOPIC TAGS: plasma, plasma diagnostics, luminescent probe, plasma-
scope, moving plasma configuration, plasma electron image, plasma
ion image, plasma configuration

ABSTRACT: The luminescent probe ("plasmoscope") method developed
by L. I. Yelizarov and A. V. Zharinov and reported by them at the
Nuclear Fusion Conference in Salzburg (4--9 September 1961) is used
to study the transverse motion of a plasma jet in a magnetic field
in the presence of translational velocity perpendicular to the sur-

Card 1/4

10607-51 EWT(1) IJF(c) AT
ACC-NR AT6033031

SOURCE CODE: UR/2504/0 32/000/0007/0019

AUTHOR: Batanov, G. M.; Grebenshchikov, S. Ye.; Ivanovskiy, M. A.; Sbitnikova, I. S.;
Fedyanin, O. I.; Shpigel', I. S.

ORG: none

TITLE: Injection of a plasma into a closed magnetic trap with a two phase helical field

SOURCE: AN SSSR. Fizicheskiy institut. Trudy, v. 32, 1966. Fizika plazmy (Plasma physics), 7-19

TOPIC TAGS: plasma injection, magnetic trap, helical magnetic field

ABSTRACT: A plasma injected into a closed magnetic trap must have the following properties: 1) it must be sufficiently homogeneous in composition (hydrogen or deuterium), it must contain a minimum number of impurities, and the percent ionization must be close to 100; 2) its temperature must be high enough to exclude losses due to normal diffusion in the magnetic field; 3) it must have a high conductivity to eliminate polarization due to the toroidal effect; 4) the plasma, filling the toroidal trap, must not contain marked longitudinal electric fields. The article presents the results of an investigation of several methods of injection. The experiments were carried out in laboratory scale models. The first method tested was injection of the

Card 1/2

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ACC NR: AT6033031

plasma into a "programmed" magnetic field; this method is based on the irreversible change in the configuration of the magnetic field into a determined region of a closed field. The behavior of a plasma was studied under rapid compression by an external azimuthal magnetic field. The method proposed in the article involves injection of the plasma along the tube of the lines of force of a magnetic field extracted from the volume of the trap. Particular attention is paid to the problem of the movement of a sufficiently dense plasma ($n = 10^{12}-10^{13} \text{ cm}^{-3}$) in a curvilinear magnetic channel. The article concludes with a consideration of the collision of plasma flows in the transverse magnetic field of the trap. "In conclusion the authors consider it their duty to thank M. S. Rabinovich for his continuing interest in the progress of the work and for his helpful discussions of the experimental results and of the selection of the basic directions of the investigation. They also thank all their coworkers who took part in setting up the physical equipment and in carrying out the experiments: Ye. P. Aleksandrov, M. S. Berezhet'skiy, N. M. Zverev, Yu. G. Krutikov, N. V. Perov, as well as all the workers of the workshop headed by V. P. Solov'yev." Orig. art. has: 13 figures.

SUB CODE: 20/ SUBM DATE: none/ ORIG REF: 015/ OTH REF: 007

Card 2/2 *6/70*

ACCESSION NR: AP4037614

S/0056/64/046/005/1915/1917

AUTHOR: Batanov, G. M.; Ivanovskiy, M. A.; ²⁶⁰⁴⁰¹Shpigel', I. S.

TITLE: Particle losses and configuration of plasma jet moving through a curvilinear magnetic field

SOURCE: Zh. eksper. i teor. fiz., v. 46, no. 5, 1964, 1915-1917

TOPIC TAGS: plasma, plasma in curved field, plasma in homogeneous field, plasma particle loss, plasma jet nucleus, plasma jet tongue, plasma ion distribution

ABSTRACT: Unlike in earlier investigations, the parameters of a plasma jet passing through a curvilinear magnetic field were studied further by letting the jet continue to move in a homogeneous magnetic field. The plasma jet moved from the gun first in a homogeneous field (3 kOe) for 50 cm, then through a curved field of 6 cm radius, and then again through a 120 cm homogeneous field (1 kOe). The plasma density was approximately 10^{12} cm^{-3} and the electron temperature 5 -- 10 eV. The measurement procedures are described briefly. The tests have shown that some 1--2 microseconds following its passage through the curved field the plasma jet acquires a "tongue" in which the plasma drifts towards the chamber walls, along with the

Card 1/3

ACCESSION NR: AP4037614

main "nucleus" of the plasma jet, which continues to move along the magnetic field and has a high density (dielectric constant close to 1000). This is in qualitative agreement with the dependence of the ion distribution on the magnetic field (cf. figure) and is confirmed by measurement of the electric field near the plasma jet "nucleus" Orig. art. has: 2 figures.

ASSOCIATION: Fizicheskii institut im. P. N. Lebedeva AN SSSR (Physics Institute, AN SSSR)

SUBMITTED: 03Jan64

ENCL: 01

SUB CODE: ME

NR REF SOV: 002

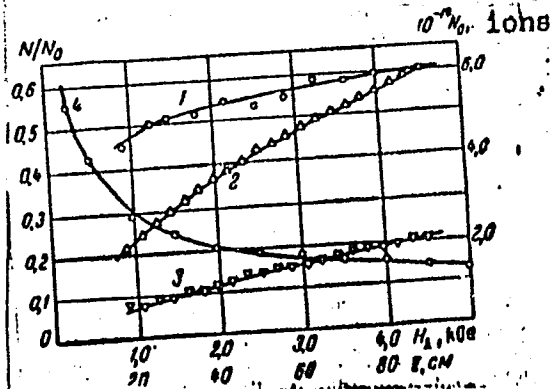
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ACCESSION NR: AP4037614

ENCLOSURE 01



Curve 1 - total number (N_0) of ions

injected by the gun into a homogeneous magnetic field H_L , as a function of the magnitude of the field H_L .

Curves 2 and 3 - ratio N/N_0 (N -

total number of ions passing through the cross section of the chamber at distances 10 and 80 cm from the turn) as a function of H_L , for $H_L/H_0 = 3$.

Curve 4 - variation on N/N_0 along the chamber, for $H_L/H_0 = 3$ and $H_L = 2.7$ kOe

Card

3/3

IVANOVSKIY, M.D.

PLAKSIN, Igor' Nikolayevich, redaktor; RUDENKO, Konstantin Gerasimovich;
SMIRNOV, Aleksandr Nikolayevich; TROITSKIY, Aleksandr Vasil'yevich;
FISHMAN, Mikhail Aleksandrovich; IVANOVSKIY, M.D., redaktor;
ROMANOVA, Z.A., redaktor; KOROVIKOVA, Z.A., Tekhnicheskiy
redaktor.

[Technological equipment of concentration plants] Tekhnologicheskoe
oborudovanie obogatitel'nykh fabrik. Moskva, Ugletekhizdat.
Pt. 1. [Design and selection of equipment] Raschet i vybor oboru-
dovaniia. 1955. 415 p. (MLRA 9:1)

1. Chlen-korrespondent AN SSSR (for Plaksin)
(Coal preparation)

18.2000

77718
SOV/149-60-1-7/27

AUTHORS: Astaf'yeva, A. V., Ivanovskiy, M. D., Shabarin, S. K.

TITLE: Beneficiation of Poor Copper-Cobalt Ore by Hydrometallurgical Processes

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya 1960, Nr 1, pp 50-56 (USSR)

ABSTRACT: Cobalt ores of the Soviet Union are characterized by low Co content. Considerable difficulties encountered in dressing are due to very fine dispersion of Co minerals. This article deals with a laboratory test of dressing ore of this type from one of the deposits in the Krasnoyarsk region (not named). The size of Co mineral inclusions ranged from 0.001 to 0.1 mm minus mesh with a total content of 0.086% Co in the ore. The other components were: (%) 65.0 SiO₂, 13.7 Al₂O₃, 3.4 Fe, 3.6 CaO, 1.8 MgO, 0.05 Mn, 1.5 S, 0.12 Sb, 1.63 As, 0.88 Cu, 0.23 Ni, and 37.4 g/ton Ag. About 20% cobalt content

Card 1/7

Beneficiation of Poor Copper-Cobalt Ore
by Hydrometallurgical Processes

77718
SOV/149-60-1-7/27

consisted of oxidized minerals and 80% arsenides and sulfoarsenides. The mineralogical analysis was made by A. I. Vitushkina and it disclosed the presence of safflorite, smaltite, glaucodote, aeritrite, tetraedrite, tennantite, chalcopyrite, covellite, malachite, rammelsbergite, chalcantite, annabergite, and silver. The dressing tests comprised the following stages. The first determined the advantages of collective vs selective flotation, each having its own set of reagents. Collective flotation was given preference while selective flotation produced concentrate richer in Co (1.22 vs 1.01%), Co losses in tailings were much higher (16.7% Co content in ore vs 10.6%). After deciding in favor of collective flotation, two variations were tried: (a) with one-stage crushing, three reruns, and selective flotation of the copper-cobalt concentrate; (b) with two-stage crushing, three flotations, selective flotation of the first concentrate, and three reruns of the cobalt concentrate. Alternative (b) proved to be best and resulted in a 10%

Card 2/7

Beneficiation of Poor Copper-Cobalt Ore
by Hydrometallurgical Processes

77718
SOV/149-60-1-7/27

higher rate of Co extraction. Following details of this method are given: The first crushing reduces 45% ore to minus mesh 0.074 mm; in the second crushing this figure is raised to 80%. Crushing is done with soda addition (250 g/ton). During the first flotation 100 g/ton butyl xanthogenate and 30 g/ton pine oil are added; during the second and third flotation, 50 g/ton sodium sulfide, 100 g/ton amyl xanthogenate, and 70 g/ton foaming agent D (not specified). Total flotation time is 40 min. During recleaning operations water glass (500 g/ton) and amyl xanthogenate were added. To eliminate excessive flotation reagents carbon (100 g/ton) was introduced into selective flotation as well as lime (8 kg/ton) as a depressant for cobalt minerals and pyrite. Cobalt extraction according to this schedule reached 70.68%, and the concentrate contained 1.17% Co. Selective flotation methods as suggested by S. I. Krokhnin and B. D. Nekrasov and finishing by gravitation as used at the Silence plant, Canada, has failed to produce satisfactory results. Subsequently, hydrometallic

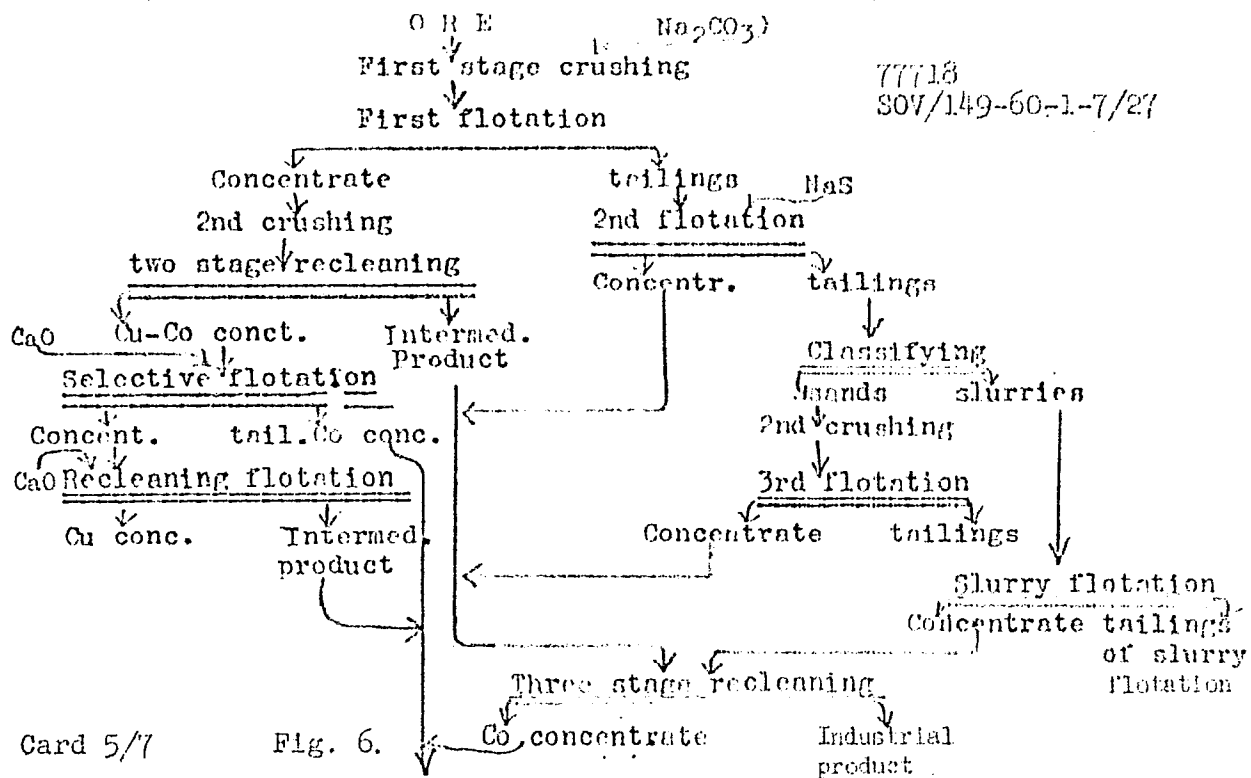
Card 3/7

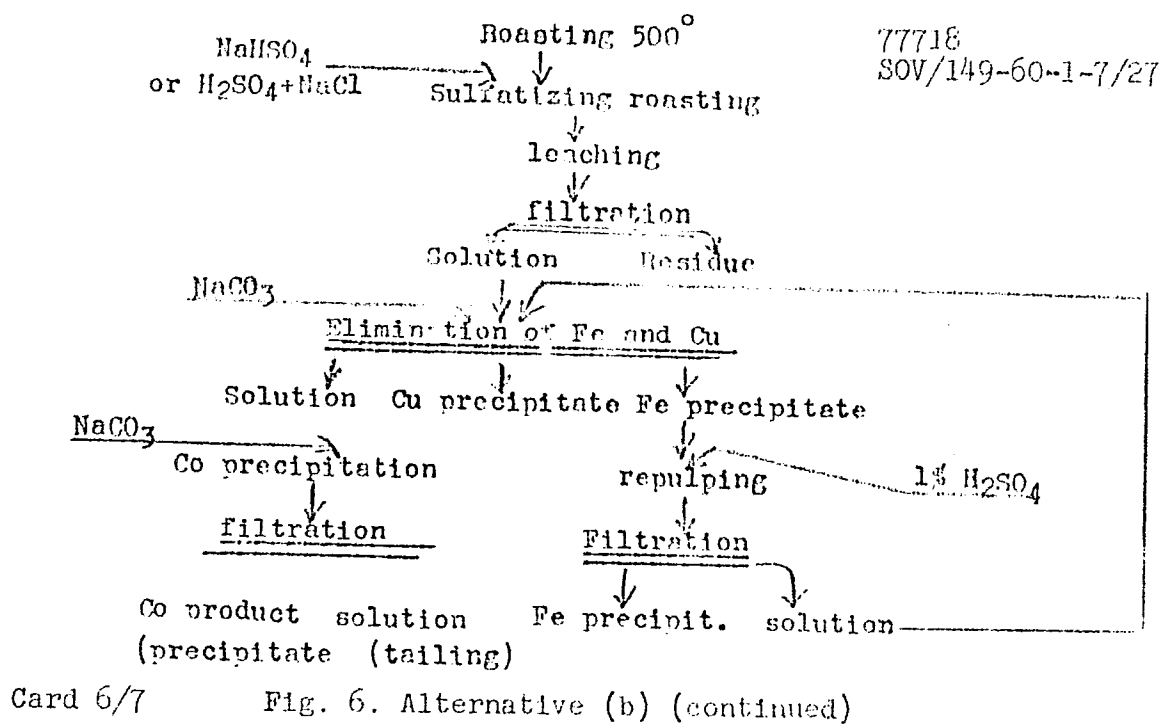
Beneficiation of Poor Copper-Cobalt Ore
by Hydrometallurgical Processes

77718
SOV/149-60-1-7/27

methods were adopted as shown in the process flow chart below (Fig. 6). Cobalt concentrates as obtained from flotation were processed in following stages: oxidizing roasting at 500^o, sulfatizing roasting with sodium bisulfate at 700^o for 2 hrs, leaching by water, and weak sulfuric acid solution. Under these conditions 90 to 95% available Co passes into the solution. The latter is separated from iron and copper by soda: Fe is precipitated at pH=4.2, Cu at pH=5.2. Cobalt is precipitated by soda (70 mg/liter) or sodium sulfide. The final product contains 12-14% Co at a 84-85% rate of extraction from the concentrate. These processes are incorporated in the flow chart (see Fig. 6). The Co extraction rate from ore amounts to 61.0%, that of Cu is 78.4%. The conclusions contain a short recapitulation of the above data. There are 4 tables; 6 figures; 5 references, 3 Soviet, 1 Canadian, 1 U.K. The Canadian and U.K. references are D. C. McLaren, Can. Mining J., Vol. 66, March 1945; H. L. Talbat, Eng. Mining J., August 1953.

Card 4/7





Beneficiation of Poor Copper-Cobalt Ore
by Hydrometallurgical Processes

77718
SOV/149-60-1-7/27

ASSOCIATION: Krasnoyarsk Institute of Non-ferrous Metals. Chair of
Metallurgy of Noble Metals (Krasnoyarskiy institut
tsvetnykh metallo. Kafedra metallurgiyi blagorodnykh
metallov)

SUBMITTED: May 26, 1959

Card 7/7

S/149/60/000/005/003/015
A005/A001

AUTHORS: Astaf'yeva, A.V., Ivanovskiy, M.D. and Sharadin, S.K. 21 27
TITLE: Chemical-Metallurgical Methods of Processing Oxidized Lead-Zinc
Ores
PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya,
1960, No. 5, pp. 49-57

TEXT: The use of flotation, gravitation and other concentration methods for oxidized ores where lead and zinc minerals are closely associated to iron hydroxides and are represented by oxidized minerals, did not yield satisfactory results (Mineralogical analysis of ores was made by A.I. Vitushkina). The investigation of various chemical-metallurgical methods for the extraction of valuable metals from such ores proved the possibility of employing the following processes: 1) Chlorination roasting with sodium chloride to sublimate lead, gold and silver. This is the shestern method. After crushing, the ore is roasted with sodium hydroxide in a furnace. The lead chlorides formed, are sublimated and collected after cooling in the form of dust. Sodium hydroxide consumption is 10% from the ore weight during roasting for 2-3 hours. For ores where the basic

Card 1/6

S/149,60/000/005/003/015
A006/A001

Chemical-Metallurgical Methods of Processing Oxidized Lead-Zinc Ores

valuable constituent is lead (7.5%). 700°C is the optimum temperature of roasting; in this case lead extraction into the sublimate attains 93.4% and the lead content in the sublimate dust 65-75%. 2) Lixivation of gold, lead and silver with metal chloride solutions. Lead may be extracted into alkali metal solutions by direct leaching-out in the presence of hydrochloric acid and ferric chloride: $PbO + 2NaCl + H_2O = PbCl_2 + 2NaOH$. The lead chloride dissolves in the excess of solvent. Best results were obtained in leaching out with solutions of two compositions: 300 g/l NaCl + 50 g/l HCl and 300 g/l NaCl + 100 g/l $FeCl_3$ + 25 g/l HCl. Experiments have shown that lead extraction into NaCl solutions without addition of hydrochloric acid was 90% and in the presence of 40-50 g/l HCl increased to 97-98%. 3) Sulfatizing roasting with ammonium sulfate and leaching out of zinc by weak solutions of sulfuric acid. Experiments have shown that sulfatizing roasting should be conducted at 500°C for 2 hours. Leaching out of zinc may be performed with weak 5% sulfuric acid solutions at 60°C. Depending on the consumption of $(NH_4)_2SO_4$ 70 to 94.5% Zn passes into the solution. For ores

Card 2/6

3/149/60/000/005/003/015
A006/A001

Chemical-Metallurgical Methods of Processing Oxidized Lead-Zinc Ores

with high zinc content the following processes may be used: 1. Chlorination roasting with sodium chloride at 1,100°C according to Figure 9. 2. Chlorination roasting at 700°C, sulfatizing roasting at 500°C with ammonium sulfate and leaching out of zinc with weak sulfuric acid solution (Figure 9, dotted line). 3. Sulfatizing roasting at 500°C with $(\text{NH}_4)_2\text{SO}_4$ and leaching out of zinc with subsequent leaching out of lead with metal chloride solutions according to Figure 10. 4. After sulfatizing roasting and leaching out of zinc, and drying of the residue, roasting with NaCl at 1,100°C (Figure 10, dotted line); in this case lead, gold and silver are extracted into the sublimate.

Card 3/5

S/149/60/000/005/003/015
A006/A001

Chemical-Metallurgical Methods of Processing Oxidized Lead-Zinc Ores

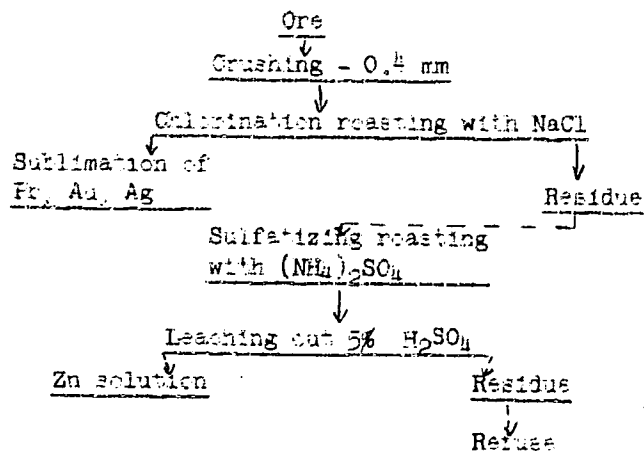


Figure 9. Schematic representation of chlorination roasting with NaCl

Card 4/6

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Chemical-Metallurgical Methods of Processing Oxidized Lead-Zinc Ores

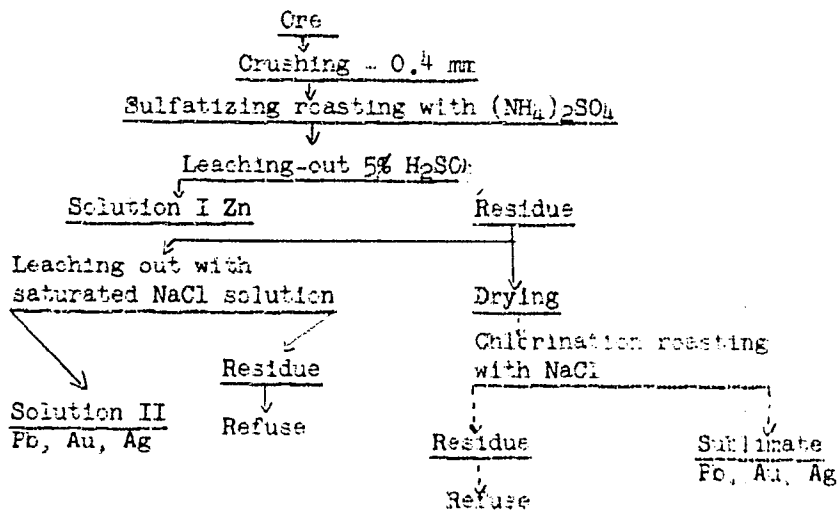


Figure 10. Schematic representation of sulfatizing roasting with $(\text{NH}_4)_2\text{SO}_4$
Card 5/6

S/149/60/000/005/003/015
A006/A001

Chemical-Metallurgical Methods of Processing Oxidized Lead-Zinc Ores

There are 8 tables, 10 figures and 6 references: 4 Soviet and 2 English.

ASSOCIATION: Krasnoyarskiy institut sovetnykh metallov (Krasnoyarsk Institute
of Non-Ferrous Metals) Kafedra metallurgii blagorodnykh metallov
(Department of Metallurgy of Precious Metals)

SUBMITTED: January 30, 1960

✓

Card 6/6

VYAZEL'SHCHIKOV, Viktor Petrovich; PARITSKIY, Zakhar Nikonovich;
IVANOVSKIY, M.D., prof., red.; MARENKOV, Ye.A., red.;
MISHARINA, K.D., red. izd-va; DOBUZHINSKAYA, L.V., tekhn. red.

[Handbook on the treatment of gold-bearing ores and placers]
Spravochnik po obrabotke zolotosoderzhashchikh rud i rossypei.
Pod red. M.D.Ivanovskogo. Moskva, Metallurgizdat, 1962. 650 p.
(MIRA 15:12)

(Gold—Metallurgy)

ACC NR: AP7007206

(N)

SOURCE CODE: UR/0186/66/008/006/0705/0707

AUTHOR: Merkin, E. N.; Ivanovskiy, M. D.; Borbat, V. F.

ORG: none

TITLE: Study of the extraction of uranium, thorium and associated elements with monocarboxylic acids

SOURCE: Radiokhimiya, v. 8, no. 6, 1966, 705-707

TOPIC TAGS: uranium, thorium, aliphatic carboxylic acid, fatty acid, solvent extraction

ABSTRACT: The extraction of uranium, thorium and associated elements with fatty acids of the C₇-C₉ fraction was studied at 20±2°. The dependence of the extraction on the equilibrium pH of the aqueous phase and IR spectra confirmed that the extraction consists of cation exchange reactions



where nHR and MeR_n are the organic phase and HR is the fatty acid C_nH_{2n+1}COOH. The presence of cation exchange permits one to expect the separation of the elements studied in sulfate solutions. On the basis of data reported in the literature and their own results, the authors suggest the following extraction capacity series:

Card 1/2

UDC: 546.791'841'72'621:542.61:547.295

ACC NR: AP7007206

$\text{Sn}^{4+} > \text{Bi}^{3+} > \text{Fe}^{3+} > \text{UO}_2^{2+} > \text{Th}^{4+} > \text{Pb}^{2+} > \text{Al}^{3+} > \text{Cu}^{2+} >$
 $> \text{Cd}^{2+} > \text{Zn}^{2+} > \text{Ni}^{2+} > \text{Co}^{2+} > \text{Fe}^{2+} > \text{Mn}^{2+} > \text{Mg}^{2+} > \text{Na}^{+}$

Orig. art. has: 2 figures.

SUB CODE: 07/ SUBM DATE: 12Apr66/ ORIG REF: 006

Card 2/2

CHECHYAK, Abram Samuilovich; IVANOVSKIY, M.D., prof., retsuzent;
ZVEREV, L.V., kand. tekhn. nauk, otv. red.

[Chemical dressing of ores] Khimicheskoe obogashchenie rud.
Moskva, Nedra, 1965. 201 p. (MIRA 18:9)

I V A N O V S K I Y , M . N .

307/3507

PLATE 1 BOOK REPRODUCTION

24(6)

Abdumajidovich SSSR. Energeticheskii Institut
Voprosy teploobmena (Heat-Exchange Problems) Moscow, 1959. 237 p. Errata slip
inserted. 2,800 copies printed.
Repr. Ed.: M.N. Ivanovskiy, Academician; Ed. of Publishing House: O.B. Gurevich;
Tech. Ed.: I.P. Kuz'min.

PURPOSE: This collection of articles is intended for scientific workers, engineers,
and postgraduate students specializing in thermodynamics.

CONTENTS: The collection reviews problems of heat transfer and explores possibilities of expanding heat exchange. The heat exchange theory is outlined, and Russian scientists who contributed to its development are mentioned. Thermophysical properties of some molten metals and alloys are analyzed, and methods used to determine them presented. Equipment used for measuring thermal conductivity, heat capacity, and kinetic viscosity of these metals are discussed. Results of experimental study of the intensity of heat exchange for a water flow in a smaller channel are analyzed and the instruments used along with the pilot plant for studying convection heat transfer in contacting semiconductible fluids are described. Instruments and equipment used for determining the linear expansion of metals, the consumption of a liquid, and the absorption capacity of a surface are also described and illustrated. A number of equations for solving various thermodynamic problems are presented. Each article is accompanied by references, the majority of which are Soviet.

TABLE OF CONTENTS:

Editorial Foreword	3
Ivanovskiy, M.N. Development of the Science of Heat Exchange During the Last Forty Years	5
Ivanovskiy, M.N., E.A. Kalashnikov, I.M. Pribludin, I.Y. Krasov, and V.A. Vasilchenko. Thermophysical Properties of Some Molten Metals and Alloys	11
Pribludin, I.M. Heat Capacity of Molten Metals	26
Sidorov, E.A. Radiation and Convection Heat Exchange in an Absorbing Medium	49
Polyanskiy, O.S. Intensification of Heat Exchange for the Flow of Water in an Annular Channel	53
Deryagin, I.N., and O.S. Polyanskiy. Convective Heat Exchange in a Direct Contact of Immiscible Fluids	67
Prill, R.L., V.I. Subbotin, M.Ye. Anovaya, and M.P. Stryunov. Study of Heat Transfer to Solim-Fullerium Alloy in a Pipe	80
Kondratyev, N.N. Average Heat Transfer for a Turbulent Flow of Eutectic Bismuth - Lead Alloy in Short Pipes	95
Ivanovskiy, M.N. Accelerated Method for Determining the Coefficient of Average Heat Transfer in a Pipe	100
Abramov, V.M. Application of Electromagnetism to the Solution of Problems of Radiant Heat Exchange	113
Leitchuk, V.A., and B.V. Dvoryashin. Heat Transmission from a Wall to a Turbulent Air Flow in a Pipe and the Hydraulic Resistance at High-Temperature Pressure Beds	123
Minskikh, M.Ye., V.I. Subbotin, P.A. Ushakov, and A.A. Sholokhov. Utilization of a Microthermocouple in Studying Heat Transfer	193
Kozlov, E.A. Unit for Metallization Carried out by Sublimation of Metals in a Vacuum	202
Kerzhakov, Yu.A. Instrument for Measuring the Consumption of a Liquid	206
Pulayev, R.I. Distribution of Velocity and Temperature for a Turbulent Liquid Flow in a Circular Pipe	208
Khrustalev, B.A. Instrument for Determining the Absorption Capacity of a Surface	233

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SOV/89-5-3-13/32

AUTHORS: Subbotin, V. I., Ibragimov, M. Kh., Ivanovskiy, M. N.

TITLE: Turbulent Temperature Pulsations in a Flow of Liquid.
Letter to the Editor

PERIODICAL: Atomnaya energiya, 1960, Vol 8, Nr 3, pp 254-257 (USSR)

ABSTRACT: Pulsations of velocity of a turbulent flow of liquid cause turbulent temperature pulsations during heat exchange. The authors investigated the effect using movable thermocouples of low heat capacity. One type consisted of an open junction 0.2 mm in diam and the other of a junction inside a thin-walled container 0.5 or 0.8 mm in diam. One construction is described in detail by Kirrillov and others (Atomnaya energiya, 6, Nr 4, 382 (1959)). The heat flow was produced by means of electrical heating elements. The thermocouple data were registered by means of fast automatic potentiometers EPP-09 Class 0.5, covering the whole scale, 0 to 0.5 mv, in 1 sec. Results are shown on Fig. 1 and 2.

Card 1/6

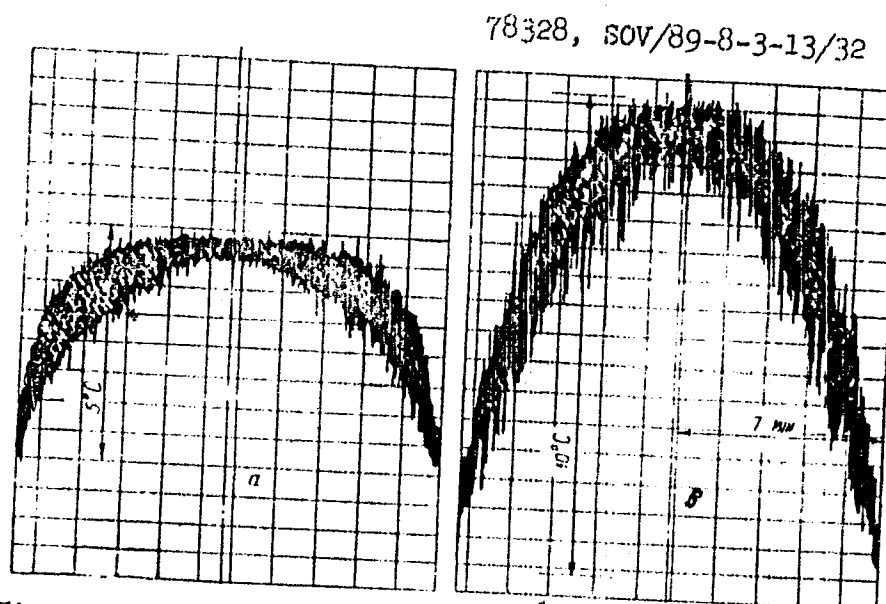
Turbulent Temperature Pulsations in a Flow
of Liquid. Letter to the Editor

78328

SOV/89-8-3-13/32

Typical liquid metal time curve of pulsation is shown in Fig. 3. Similar results were obtained in water. The authors found that the amplitude and frequency of temperature pulsation depend on the size of the heat flow, the physical properties, the type of flow of the liquid, and on the dimensionless distance from the wall. Temperature pulsations inside the wall were damped as one leaves the heat exchange region. It was established that pulsations persist some 2-5 sec after the end of heating and then start slowly to dampen out. The reverse happens after switching the heat on. The pulsations accompany the existence of a temperature gradient in the liquid. Various methods of pumping had no influence on the pulsations. Likewise, the frequency of the heater current and 3% fluctuations of the heating power did not produce any change in the pulsation pattern. The authors took care to eliminate all possible causes of mechanical vibrations, and they are sure that the measured temperature oscillations are due to the turbulent pulsations of the temperature

Card 2/6



Card 3/6

Fig. 1. Temperature profile in liquid metal flow: (a) $Re = 230,000$; $q = 50,000 \text{ kcal/m}^2 \cdot \text{h}$; (b) $Re = 30,000$; $q = 20,000 \text{ kcal/m}^2 \cdot \text{h}$.

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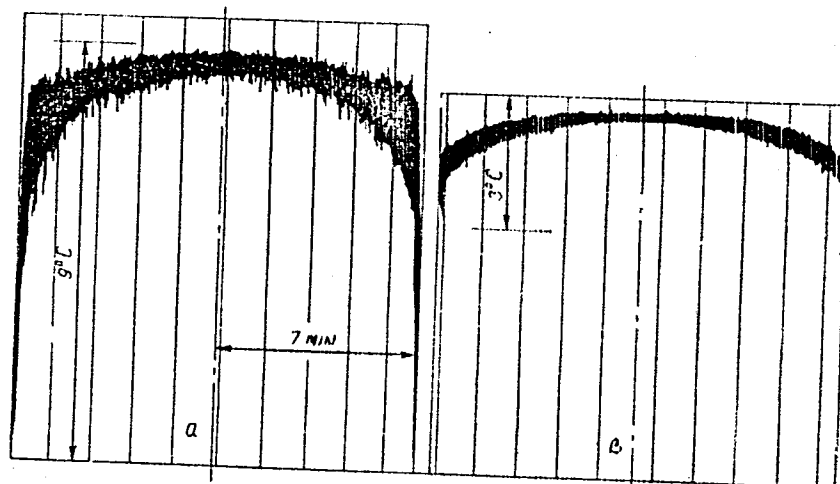


Fig. 2. Temperature profile in water flow: (a) $Re = 8,900$; $q = 30,000 \text{ kcal/m}^2 \cdot \text{h}$; (b) $Re = 35,000$; $q = 50,000 \text{ kcal/m}^2 \cdot \text{h}$.

Card 4/6

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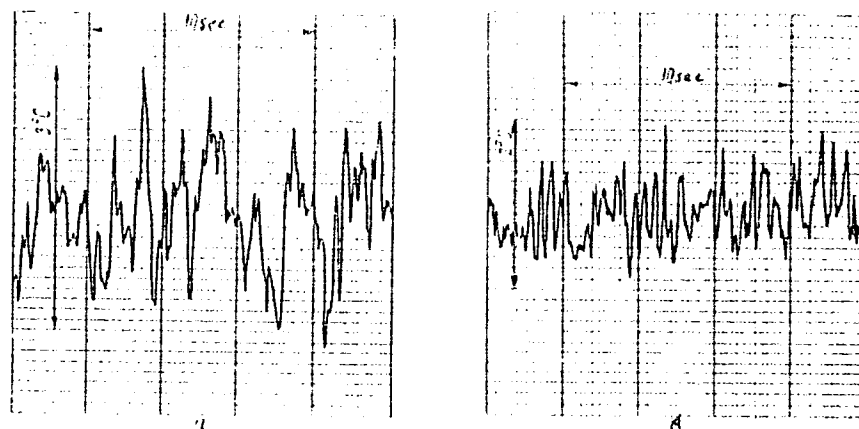


Fig. 3. Time curve of temperature pulsation of a flow of liquid metal in region of maximum amplitudes: (a) $Re = 30,000$; $q = 20,000 \text{ kcal/m}^2 \cdot \text{h}$; (b) $Re = 230,000$; $q = 50,000 \text{ kcal/m}^2 \cdot \text{h}$.

Card 5/6

Turbulent Temperature Pulsations in a Flow
of Liquid. Letter to the Editor

78328

SOV/89-8-3-13/32

in the flow. The amplitude variations with radius observed on Figs. 1 and 2 agree with the hypothesis that the magnitude of turbulent temperature pulsation is proportional to the mixing path length l and the temperature gradient, except that the pulsations differ from zero even in the center of the tube and on its walls. Thermocouples used were able to react to frequencies up to 100 cycles/sec without amplitude distortion. The registering device could follow up to 20 c/sec. The frequencies registered in these tests obviously did not represent the whole spectrum of temperature pulsations, and the authors plan to continue investigations using still more perfected instruments with small thermal inertia. Ye. V. Nomofillov, M. N. Arnol'dov, and Yu. N. Pokrovskiy helped build the experimental apparatus and took part in measurements. A. I. Leypunskiy and A. P. Aleksandrov gave advice and showed interest in the work. There are 4 figures; and 2 Soviet references.

SUBMITTED:
Card 6/6

October 12, 1959

IVANOVSKIY, M. N., ARNOL'DOV, M. N, NOMOFILOV, Ye. M., SUBBOTIN, V. I., and
IBRAGIMOV, M. K.

"Heat Emission and Turbulent Heat Transfer in a Flow of Liquid Metals."

Report submitted for the Conference on Heat and Mass Transfer, Minsk,
BSSR, June 1961.

SUBBOTIN, V.I.; IBRAGIMOV, M.Kh.; IVANOVSKIY, M.N.; ARNOL'DOV, M.N.;
NOMOFILOV, Ye.V.; ATENKOV, S., tekhn. red.

[Heat transfer and turbulent heat transport in a flow of liquid
metals; Conference on Heat and Mass Transfer, Minsk, January
23-27, 1961] Teplootdacha i turbulentnyi perenos tepla v potoke
zhidkikh metallov; soveshchanie po teplo-i massoobmenu, g. Minsk,
23-27 ianvaria 1961 g. Minsk, 1961. 18 p. (MIRA 15:2)
(Heat—Transmission) (Liquid metals)

11. 3950
11. 9200

S, 069, 01, 010, 004, 010, 027
B102/B205

AUTHORS: Subbotin, V. I., Ibragimov, M. Kh., Ivanovskiy, M. N.,
Arnol'dov, M. N., Nomofilov, Ye. V.

TITLE: Turbulent heat transfer in a flow of liquid metals

PERIODICAL: Atomnaya energiya, v. 10, no. 4, 1961, 384-386

TEXT: The modern theory of turbulence does not permit an analytic determination of a turbulent heat transfer in a flow of liquid matter. As shown by the present study, the semi-empirical theory of heat transfer which makes use of the analogy of heat transfer and momentum transfer, makes it possible to perform such studies. This can be proved by measuring the temperature fields in liquid metals. On account of the high thermal conductivity of liquid metals, the temperature drop is not limited to a thin, laminated layer like in ordinary liquids but extends to the turbulent core. Martinelli was the first to apply the theory of hydrodynamical analogy to liquid metals, taking into account the molecular heat conductivity in the turbulent core of the flow. Calculations were based on the assumption that the ratio of the coefficients of turbulent heat transfer

Card 1/7

22613

Turbulent heat...

S/089/61/010/004/016/027
B102/3205

and of momentum transfer (ϵ_a/ϵ_v) were independent of the radius and the flow velocity. Lion has derived a general equation for the heat-transfer coefficient in a tube:

$$\frac{1}{Nu} = 2 \int_0^1 \frac{\left[\int_0^1 \frac{u}{w} \xi d\xi \right]^2}{\left(1 + \epsilon \frac{\epsilon_v}{v} Pr \right) \xi} d\xi. \quad (1)$$

where $\xi = r/r_0$ and, using the results of Martinelli with $\epsilon = \epsilon_a/\epsilon_v = 1$, he obtained $Nu = 7 + 0.025 Pe^{0.8}$. Martinelli's and Lion's assumption that $\epsilon = 1$ has not yet been confirmed experimentally. Voskresenskiy, Deissler, Jenkins et al. have found experimentally that ϵ was much smaller than 1. On the basis of measurements of the temperature fields in flowing water and flowing liquid metals, the authors have made an attempt to determine the turbulent heat-transfer coefficient and ϵ for liquid metals, and to study the effect of the thermal conductivity of the metals on these quantities. The former quantity was calculated from the equation

$$\epsilon_a = \frac{q/q_0}{\partial t / \partial \xi} \frac{r_0 q_0}{c_p \gamma} - a \quad (3).$$

Card 2/7

Turbulent heat...

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B102/B205

The ratio of the local heat flow to the heat flow on the wall was found from the equation

$$q/q_0 = \frac{1}{\xi} \frac{u^*}{w} \left[(4.25 + 2.5 \ln y^+) \xi^2 - 2.5 \hat{\xi} - 2.5(1 - \xi^2) \ln(r_0/y) \right].$$

The temperature gradients determined by graphical methods make it possible to calculate ϵ_a from Eq. (3). Fig. 1 shows the distribution of ϵ_a across the tube cross section. ϵ_a grows with increasing distance from the wall and with increasing Re number, wherefrom it follows that $\epsilon_a \neq 0$ in the center of the tube. The curves shown in Fig. 1 hold for a heavy metal. The $\epsilon_a(\xi)$ curves taken for alkali metals show a similar course, but the maximum is hardly marked at high Re numbers. Fig. 2 shows the experimental curves $\epsilon_a/\lambda = f(\xi)$ (continuous lines) as compared with those calculated according to Lion (-----) and those obtained for heavy metal (A) and alkaline metal (B) according to Voskresenskiy (-----). A comparison between measured and theoretically determined temperature fields (Fig. 3) shows that the assumption $\epsilon = 1$ increases the influence of turbulent heat transfer at small Re numbers but reduces it at high Re numbers. According to the Re number, ϵ is thus higher or lower than 1.

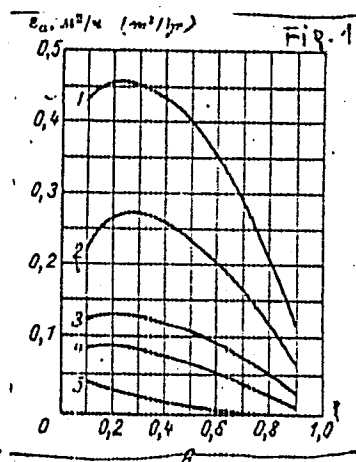
Card 3/7

Turbulent heat...

S/089/61/010/004/016/027
B102/B205

Fig. 4 shows $\epsilon = f(Re)$ at $\xi = 0.8$ for water (\circ), alkaline metal (\bullet), and heavy metal (\circ). There are 4 figures.

SUBMITTED: July 14, 1960



Card 4/7

26368

S/089/61/011/002/004/015
B102/B201

215240

AUTHORS: Subbotin, V. I., Ibragimov, M. Kh., Ivanovskiy, M. N.,
Arnol'dov, M. N., Nomofilov, Ye. V.

TITLE: Heat transfer with a turbulent flow of liquid metals in tubes

PERIODICAL: Atomnaya energiya, v. 11, no. 2, 1961, 133-139

TEXT: This is a report on a study of heat transfer occurring with a turbulent flow of liquid alkali and heavy metals in tubes. In the range of $Pe = 10^2 - 10^4$, experimental data on heat transfer to liquid metals differ considerably; they may, on the whole, be grouped into two classes which are characterized by $Nu = 7 + 0.025 Pe^{0.5}$ (1) and $Nu = 3.3 + 0.014 Pe^{0.8}$ (2). The authors determined the heat-transfer coefficients by two methods: by measuring the temperature field in the flow of liquid metal, and by measuring the wall temperature and the mean temperature of the liquid metal. Fig. 1 shows the experimental setup traversed by the metal vertically (from bottom to top). The characteristics of the experimental setup are as follows:

Card 1/6

Heat transfer with a turbulent ...

26368

S/CB9/61/011/002/004/0.5
B102/B201

	Part 1	Part 2
tube material	steel 1X18H9T (1Kh18N9T)	steel 1X18H9T (1Kh18N9T)
outer tube diameter	42 mm	34 mm
inner tube diameter	31.1 mm	29.3 mm
distance between tube inlet and thermocouple	1166 mm	985 mm
length of part with heat transfer	1194 mm	980 mm
distance between beginning of heated part and thermocouple	976 mm	945 mm

All thermocouples (chromel-alumel couples) that served to measure the temperature of the liquid metal at the inlet and outlet of the test tubes, were calibrated on a platinum - platinum rhodium thermocouple. The electric power was measured by astatic wattmeters of accuracy index 0.2 and 0.5. The flow rate of the metal was measured by magnetic and throttle flow meters. The alkali metals were continuously purified from oxides (oxygen content 0.02-0.005% by weight), not so the heavy metals (oxygen content 0.02-0.005% by weight).
Card 2/6

26360

S/089/61/011/002/004/015

B:02/B201

Heat transfer with a turbulent ...

$\sim 10^{-3}\%$ by weight). The temperature in the flow was measured with mobile thermocouples on 9-12 fixed points. Special small-size thermocouples served to measure the temperature fields; the results of these measurements were in good agreement with those calculated by Lyon's theory. The wall temperature was determined by extrapolation of the temperature profile for the wall. The mean temperature of the flowing liquid metal was calculated from the formula

$$\bar{t}_{liq} = \int_0^R U t_{liq} r dr / \int_0^R U r dr, \text{ where } U = 5.5 + 2.5 \ln y^+$$

y^+ was taken as the velocity-distribution law; ($y = 0.25-0.4$ mm). The Nusselt numbers resulting from the measurement of the temperature fields are in good agreement both with one another and with the results of other authors. They are consistent with Lyon's formula (1) in the range $Pe = 100-12,000$. It is not, however, as assumed by Lyon, $\epsilon_a/\epsilon_v = 1$,

constant over the tube cross section, and independent of Pe , but radically variable, and smaller than unity for small Pe , larger than unity for large Pe . The second method takes account of the thermal contact resistance on the heat-transfer surface. The results obtained by the two methods are in

Card 3/6

26363

S/089/61/01/002/004/015
B102/B201

Heat transfer with a turbulent

agreement for alkali metals, which is indicative of the fact that there is no thermal contact resistance in them under the given conditions (purification from oxides!). No agreement was found in the case of heavy metals, i.e., there is a thermal contact resistance at the interface between tube wall and liquid metal. As was shown by further studies, this contact resistance drops exponentially with a rise of Re. Yu. N. Pokrovskiy, Engineer, and A. P. Aleksandrov, laboratory assistant, helped to prepare the experimental setup and the small-size thermocouples. There are 6 figures, 1 table, and 12 references: 6 Soviet-bloc and 6 non-Soviet-bloc. The three most important references to English-language publications read as follows: R. Lyon, Chem. Engng. Progr. 47, 2, 75 (1951); H. Brown et al. Trans. ASME, 79, No. 2, 279 (1957); R. Martinelli. Trans. ASME, 69, No. 8, 947 (1947).

SUBMITTED: August 25, 1960

Card 4/6

ACCESSION NR: AP4044529

S/0294/64/002/004/0616/0622

AUTHORS: Subbotin, V. I. (Moscow); Ivanovskiy, M. N. (Moscow); Sorokin, V. P. (Moscow); Chulkov, B. A. (Moscow)

TITLE: Heat exchange during condensation of potassium vapor

SOURCE: Teplofizika vyssokikh temperatur, v. 2, no. 4, 1964, 616-622

TOPIC TAGS: potassium, condensation, thermal property, boundary effect/ LKh18N9T steel

ABSTRACT: The authors designed special apparatus for their experiment. Saturated vapor was introduced into a cylindrical chamber 150 mm in diameter and 210 mm in height, on the bottom of which was placed an experimental condenser--a cylinder of LKh18N9T steel 62 mm in diameter and 35 mm in height. The lower part of the cylinder was cooled with water. The upper part, framed by a wall 6 mm high, served as a tray for the condensate. The vapor was condensed on the surface of liquid metal, and the condensate was discharged through the side of the tray. Temperature measurements were made only after steady thermal conditions had been established. The measurements were continued for 1-1.5 hours, with no change in

Card 1/2

ACCESSION NR: APL044529

temperature exceeding 20 during the measurements. During condensation of the metal vapor, one might expect intense heat exchange because of the high thermal conductivity of the condensate. But boundary effects are found to play an important role when thermal resistance of the condensate is small. These effects include contact thermal resistance (due to contamination on the walls), resistance during phase transition (because of temperature jumps between vapor and the liquid surface), and diffusion resistance (caused by impurities of uncondensed gases and metal vapor). This paper furnishes the first experimental data on the role of boundary effects on heat exchange during condensation of immobile potassium vapor. "Apart from the authors, V. I. Lukashov, N. V. Bakulin, and A. V. Kleymentov participated in this work." Orig. art. has: 5 figures and 2 tables.

ASSOCIATION: none

SUBMITTED: 19Apr64

ENCL: 00

SUB CODE: TD, ME

NO REF SOV: 004

OTHER: 004

Card 2/2

L 18835-66 EWT(1)/EWT(m)/ECC(k)-2/ETC(f)/EWG(m)/T/ETP(t)/EWA(h) IJP(c)
 ACC NR: AT6002505 JD/TT/JW/AT SOURCE CODE: UR/3158/65/000/022/0001/0006
 AUTHOR: Subbotin, V. I.; Ivanovskiy, M. N.; Arnol'dov, M. N. 85
 B+1
 ORG: State Committee for the Utilization of Atomic Energy SSSR, Energy Physics
 Institut (Gosudarstvennyy komitet po ispol'zovaniyu atomnoy energii SSSR, Fiziko-
 energeticheskiy institut)
 TITLE: The form of impurities in cesium used in thermionic converters 25.44
 SOURCE: Obninsk. Fiziko-energeticheskiy institut. Doklady, no. 22, 1965. Sosto-
 yaniye primoshey v tsezii, ispol'zuyemom v termoionnom preobrazovatele, 1-6
 TOPIC TAGS: thermal ionization, thermochemistry, cesium plasma, electrode, free
 energy
 ABSTRACT: The effects of air on cesium impurity formation in thermionic converters
 were studied. The oxygen and hydrogen form Cs_2O , CsH and CsOH . The hydroxide dis-
 sociated according to the reaction

$$\text{CsOH} + 2\text{Cs} \rightleftharpoons \text{Cs}_2\text{O} + \text{CsH}$$

 The equilibrium conditions for the above reactions and the dissociation of the
 Card 1/3

L 18835-66
ACC NR: AT6002505

oxide, hydride and hydroxide were thermochemically analyzed. Comparisons were made between the equilibrium constants, the partial pressures for dissociation and the free energies of the chemical reactions occurring in the thermionic converter which result in impurity formation. At 300°C the partial pressure of H₂ and O₂ for dissociation of hydride and oxide compounds of cesium varied considerably: 400 mm Hg for H₂ as against 10⁻⁶⁰ for O₂. The products of the dissociation of cesium hydroxide and oxide were shown to result in water vapor formation on the surface of the cesium. By combining the equilibrium constant it was shown that the partial pressure of the water vapor was extremely low ($P_{H_2}/P_{H_2O} = 10^{+12}$). The equilibrium conditions for impurity formation in cesium vapor, found between the electrodes of the converter, depend on the temperature and the materials from which the converter is made. In the hottest portions of the converter molybdenum is used; at temperatures of about 1500 to 2000°C, stainless steel is used for the cooler regions at temperatures of 500 to 1000°C. The equilibrium state impurities in the cesium reservoir was considered under these conditions. Data on oxygen partial pressures for various oxides of the construction materials and Cs₂O as a function of temperature (from 300 to 2000°C) are given. In the cesium reservoir (300°C) almost all of the oxide is in the form of Cs₂O, independent of the electrode composition. At higher

Card 2/3

L 18835-66

ACC NR: AT6002505

temperatures in the zone of the Mo electrode, MoO_3 forms easily, decomposing to the volatile MoO_3 . The MoO_3 then combines with the material at the "cold electrode" to form the oxide of that material. A graph of change in isobaric-isothermal potential of MoO_3 reacting with Ni, Fe, Cr, Nb and Ti as a function of temperature is given. Orig. art. has: 1 figure, 2 tables, 5 formulas.

SUB CODE: 07,10 /

SUBM DATE: none

OTH REF: 003

Card 3/3

vmb

L 06457-07 EM(m)/EnF(t)/ETI IJP(c) JD/WW/JG

ACC NR: AP6024537

SOURCE CODE: UR/0089/66/021/001/0017/0022

AUTHOR: Subbotin, V. I.; Ivanovskiy, M. N.; Milovanov, Yu. V.

82

ORG: none

5

TITLE: Diffusion-chemical and phase resistance in the condensation and evaporation of alkaline metals

SOURCE: Atomnaya energiya, v. 21, no. 1, 1966, 17-22

TOPIC TAGS: liquid metal, alkali metal, nuclear reactor coolant, heat transfer, pressure effect, physical diffusion, heat balance

ABSTRACT: The authors analyze in greater detail the now-current scheme, whereby alkaline metals evaporate by surface emission of monoatomic molecules only, and that dimerization takes place only after the evaporation. An analysis of the thermodynamic equations and comparison with earlier experimental data (Teplofizika vysokikh temperatur v. 2, no. 4, 1964) show that this scheme is valid only at higher pressures and that the evaporation or condensation of alkaline metals at supersaturated-vapor pressures of 1 - 100 mm Hg must proceed via surface emission (or absorption) of both monoatomic and diatomic molecules. At these lower pressures the dimerization (or dissociation) of molecules is a result of a chemical reaction occurring on the surface of the liquid. The existence of a transition region between high and low pressures, in which the condensation coefficient changes from zero (at high pressures) to unity (at low pressure), is proposed. The diffusion-chemical resistance depends on the kinetics of

Card 1/2

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the dimerization reaction, but there are not enough experimental data to describe this dependence in detail. It is proposed, nevertheless, that the coefficient of heat transfer at near-atmospheric pressure is quite high, even when the diffusion-chemical resistance is taken into account, and that at lower pressures the resistance is practically zero. Orig. art. has: 2 figures, 32 formulas, and 1 table.

SUB CODE: 18, 20/ SUB DATE: 20Nov65/ ORIG REF: 005/ OTH REF: 003

Card 2/2 *pla*